Rymer, Edwina

From: Hildebrandt, Kurt
Sent: Friday, October 03, 2014 12:23 PM
To: 'Todd'
Cc: Mindrup, Mary
Subject: RE: College Research Paper
Attachments: document_ew_03.pdf; State_of_Kansas_Seismic_Action_Plan_9_26_14.pdf

Todd -

Thanks for getting in touch with me. You've chosen a timely but difficult topic to tackle for a research paper as induced seismicity is certainly front and center in the news. As you're preliminary research has likely shown you, injection-induced seismicity has been well documented over the decades through both petroleum industry case studies and research at places like Rocky Mountain Arsenal and Rangely Field. By the same token, decades of disposal and oil field activity without much seismicity clearly indicates that the recent increase in seismic activity situated in production and disposal areas cannot be characterized by broad generalizations. The science around fault movement is quite complex and the available information at many sites is rarely sufficient to provide detailed answers. Therefore, definitive proof of induced seismicity being caused by disposal into a specific well is not always realistic considering the uncertainty of seismic event hypocenters and the lack of available high quality operational and subsurface information (some of which may be proprietary). This makes dealing with these events and determining a specific cause and solution to often be very difficult.

As for EPA requirements, the Underground Injection Control (UIC) program regulations do contain specific requirements for pre-drilling assessments including consideration of faults in permitting. These requirements vary slightly depending on the well class but the considerations are intended to prevent migration of fluid through direct transmission or through seismicity, either natural or induced. Other requirements refer directly to consideration of seismicity and its potential to interfere with containment. Again, this concern would be relevant to both natural and induced seismicity. Additionally, the regulations allow the UIC program director to request additional information from a permit applicant to assist them in making a permit determination if they deem it necessary. Any operational or monitoring requirements/limits would be addressed as part of the operating permit and while much of the permit language is boiler plate, those areas of the permit would be specific to the well(s) and set by the program director based on their understanding of the geologic conditions.

All UIC permits are subject to public notification and comment. So the program doesn't operate in a vacuum and concerns from parties about things like the potential for the operation to induce seismic events can be voiced. The director also has the ability to adjust any conditions of an existing permit if they learn that the operation of the well may be endangering an underground sources of drinking water (USDWs). USDWs are defined as aquifers or portions of an aquifer which contain water with Total Dissolved Solids in concentrations of less than 10,000ppm. It is the view of the Agency that seismic events which are related to injection activities do have the potential to endanger USDWs. In other words, while the actual injection for oil and gas brine disposal or other deep disposal wells occurs below any USDW, an induced seismic event may cause the movement of non-USDW fluids into a USDW. So even a permitted well which is suspected of inducing seismicity through its operations can be re-evaluated and have the operating and/or monitoring requirements adjusted.

To assist UIC programs in addressing this issue, EPA is in the process of developing a set of practical approaches for the program director to consider should it appear that an injection activity is inducing (or triggering) a seismic event. These would not be regulatory in nature but are intended to provide a set of tools that can be used to evaluate and mitigate the potential for the injection operations to cause seismic activity. The report is currently in a draft format and has recently undergone an external peer review by a panel of experts. EPA is in the process of evaluating the reviewer's

comments and making any edits that might be required. However, an early copy of the report was released as part of a Freedom of Information Act request and I've attached a copy of that version for you to use in the development of you research paper. Please bear in mind that it is a draft and there may be some edits made to the final version based on the comments that we received from the external review group. So if you do decide to use it as a reference in your paper be sure to note in the citations that it is a preliminary draft version that you are working from.

Also, many states are being proactive and developing their own plans for addressing induced seismic events. Ohio, Oklahoma and Texas have plans on the books and Kansas has just released their plan. I've attached the Kansas plan for you to look at and if you Google "seismic activity plan" you can find other state's plans.

I hope that this at least in some part addresses the issues you've raised. Good luck on your research paper and as you'll find out, there has been a lot of research into this area and a lot more is needed to better understand the correlation between disposal well operational behavior and earthquake events.

Regards,
Kurt

Kurt F. Hildebrandt
US Environmental Protection Agency - Region 7 Water, Wetlands & Pesticides Division
11201 Renner Boulevard
Lenexa, Kansas 66219

Voice: 913-551-7413
FAX: 913-551-9413

-----Original Message-----
From: Todd [mailto:thatreallyniceguy@gmail.com]
Sent: Wednesday, October 01, 2014 2:37 PM
To: Hildebrandt, Kurt
Subject: College Research Paper

Hello Kurt,

My name is Todd Falcke and I am an engineering student at Fort Lewis College in Durango, CO who has been tasked with a research paper. I chose to pick the topic of Induced Seismicity Potential Related to Energy Projects and have come across your name multiple times during my first few days of digging. It seems as though you have an extremely intimate knowledge of this topic and I am hoping that you may be able to point me in the right direction for data. I am specifically interested in current seismic surveys and any pre-drilling assessment requirements, operational activity monitoring requirements, and extraction/injection volume limits (if any) and possible projection of risks assessment methodologies currently being used. Knowing that most risk comes from injection sites, does the EPA use a standard depth/volume/soils report in determination? I am curious about the big picture of these operations, as I would like to go into patent law related to oil and gas operations technologies. I don't want to take too much of your precious time, so if you would be kind enough to consider a few short correspondences to help me get an A+ on the paper, I would be very appreciative; and I am sure that the Prof would be impressed by the pedigree of primary source I was able to contact. Thank you for your kind consideration!

Regards,
Todd Falcke
925-570-9619